

Molybdenum carbide supported on nitrogen-doped carbon derived from kraft lignin for hydrogen evolution reaction in alkaline media

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Because of natural scarcity and high cost for Pt-based catalysts that are typically used for hydrogen evolution reaction (HER), it is crucial to develop efficient catalysts based on non-precious metals for widespread application of electrolyzer. Kraft lignin is a by-product of the chemical pulping industry and most of them are incinerated generating carbon dioxide. For the valorization of industrial lignin, we have developed a simple and eco-friendly fabrication method for molybdenum carbide nanoparticles dispersed on nitrogen-doped carbon supports ($\text{Mo}_2\text{C}/\text{NC}$) by annealing of MoCl_5 , kraft lignin, urea at 750 °C under N_2 atmosphere in one-pot. Kraft lignin has a 3D network structure with high carbon content, which can act as carbon source for formation of Mo_2C and carbon support during the synthesis. The nitrogen-doped carbon supports provided large surface area and high electrical conductivity. The resultant $\text{Mo}_2\text{C}/\text{NC}$ demonstrated efficient HER performance in alkaline solution with a low overpotential value of 131 mV at 10 mA cm^{-2} .